(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 202 676**
A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: 86106923.5

(22) Date of filing: 21.05.86

(51) Int. Cl.⁴: B 26 F 1/38

(30) Priority: 22.05.85 ES 543394

(43) Date of publication of application:
26.11.86 Bulletin 86/48

(84) Designated Contracting States:
AT BE CH DE FR GB IT LI LU NL SE

(71) Applicant: INVESTRONICA S.A.
Tomás Breton, 62
ES-28045 Madrid-7(ES)

(72) Inventor: Becerra Carrasco, Rodrigo
Urbanización 109 Villas F-17
Pozuelo Estación (Madrid)(ES)

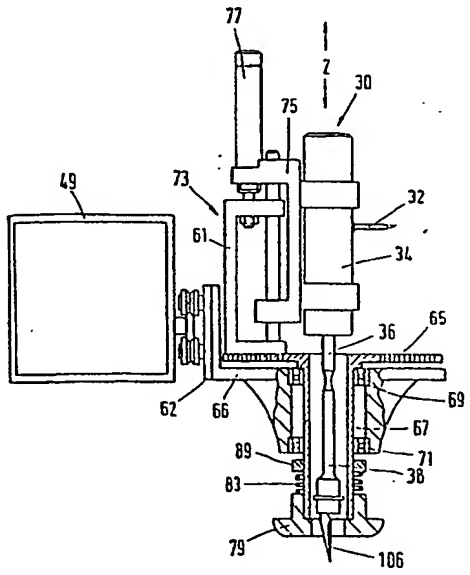
(72) Inventor: Alcantara Perez, Bernardo
C/Rioja no. 13-4 B
Madrid(ES)

(74) Representative: Puschmann, Heinz H. et al,
Spott und Puschmann Patentanwälte
Sendlinger-Tor-Platz 11
D-8000 München 2(DE)

(54) Procedure for automatically cutting pieces of material to order, using a band of material and a device for carrying out the procedure.

(57) Procedure and device for cutting pieces of material to order, from a band of material, by using a cutting table equipped with a vacuum installation for holding the band of material in place and a workable, longitudinal and traverse slide on the cutting table, running along the desired cutting lines, which is controlled by a data processor for marking and data control, as the carrier of a cutting tool driven by ultrasound, for the purpose of which a conveyor belt with a base similar to a brush serves as the means of transport for the band of material in the cutting area and as a cutting base, which is moved, step by step, by means of a slide range that, for the finished cut of a piece of material, is larger than the cutting tool's most ample movement in the longitudinal direction (X), for which purpose, the cutting tool in each case is only moved following the transportation phase, with the conveyor belt being stationary all along the cutting lines.

Fig.7



EP 0 202 676 A2

INVESTRONICA, S.A.
Tomás Bretón, 62
ES-28045 Madrid 7
Spain

Munich, 8-28-1985
P 1303/85
Pu/rei

Procedure for automatically cutting pieces of material to order, using a band of material and a device for carrying out the procedure.

The invention refers to a procedure for cutting pieces of material from a band of material, as is stated in claim 1 of the patent.

It is known from patent CH-PS 406 103, for automatically cutting pieces of cloth to order, to hold the band of cloth to be cut on a perforated cutting table by means of a vacuum-suction device and have a cutting blade, working in an up-down movement in a housed carrier moving lengthwise and crosswise of the cutting table, which is put into movement by means of command signals stored in a memory in such a way that the blade is guided along a predetermined cutting line on the band of cloth and cuts the desired pieces of cloth for this purpose. For this purpose, however, it is necessary for the cutting line of the pattern to be cut to be established as an uninterrupted line, free of crosses, and that this line be explored by a tracing device, to be able to cut to order automatically and continuously, by means of the cutting tool, the different pieces of cloth, according to the explored cutting line.

In order to increase the cutting capacity, in addition to being familiar with patent DE-OS 28 17 674, we also have knowledge of simultaneously cutting several layers of cloth placed one on top of the other, which are held in place in a like manner on a cutting table by means of a vacuum-suction device. Through the use of this cutting unit, and utilizing modern control techniques, it is not necessary then to establish the cutting line of the pattern as an uninterrupted line free of crosses and explore this line by means of a tracing device, given that in the latter process, according to the so-called NC control, all of the positioning and control data are stored as digital signals and are processed by a data processor for the purpose of generating the control signals necessary for the drive motors of the cutting tool and the tool carrier. Similar machines have been made known, for example, by patent US 3 511 124, 3 715 945 or 3 776 072.

The cutting head on the cutting tool itself is a costly mechanism to manufacture, which requires a tool carrier which is housed and works with an up-down movement for housing the blade, a first drive for the generating of the up and down movement and a second drive for the rotation of the tool carrier, as well as a third drive for the raising of the complete cutting head during its movement along the X and Y direction regarding the cutting table, as well as gears for the transmission of all of these movements. See publication DE 26 14 347.

A construction of this type is also inconvenient from the point of view of its large mass, given that during the cutting movements and along the cutting lines, this must accelerate and stop constantly, entirely independent of the fact that its maintenance is also bur-

In light of ever-increasing costs, there is a considerable demand for inexpensive installations for automatically cutting pieces of material or cloth to order.

The mission of this invention is to remedy this problem by using a new drive system for the cutting part and thus create a new procedure for automatically cutting pieces of material to order from a band of material, that is to say, to establish considerably simpler procedures than those which have been used to date.

From the point of view of the procedure in keeping with the invention, this task is resolved by means of the distinguishing characteristics in claim 1 of the patent.

An installation for carrying out the procedure is solved in light of the invention by means of the distinguishing characteristics in claim 3 of the patent.

Other characteristics of the invention stem from the subclaims

Through the utilization, in accordance with the invention, of a ultrasonic generator as the drive system for the cutting part and the configuration of the nonstop conveyor belt as the step-by-step connection part, at the same time used as a fixed cutting table during the cutting process, on which the band of material to be cut is held in place, spread out, by means of a vacuum installation, it is possible to cut a band of material with the required precision, in a considerably faster and simpler way than has been used to date, and achieve the desired cuts to order.

Regarding the cutting systems known, in which the blade stroke amounts to approximately 15-20 mm, here it is between 2 and 3, with an approximate maximum of 5 mm. For this purpose, the cutting movement frequency is much greater than in known systems. The height of the fibers on the brush surface can thus be considerably reduced regarding the presently-known systems, which provides for considerable savings.

Another advantage to be considered is the fact that the regulation of the cutting tool around axle X is much simpler to carry out than it has been to date, and because the vertical movement along axle Z can take place with the blade stopped, contrary to the known systems, in which the cutting tool, when on run free, that is to say, at maximum speed, is moved from one piece to another, thus with the process of cutting to order requiring a high capacity for free run.

The moveable carriers coordinated with the area for cutting to order are controlable by means of a data-control processor NC, in such a way - in the X and Y direction - that the cutting head can reach any designated point on the surface of the band of material.

The controlling signal for the direct current motors that move the carriers are generated in the so-called cutting line generators, thus making the directions of the movements and the accelerations and speeds controllable within ample limits.

In this way, it is possible to profitably cut different materials with NC control, such as: fabric, paper, cardboard, plastic and similar materials, material in the shape of bands in individual

layers or also in multiple layers, for the purpose of which the material to be cut can be processed from a roll or as a flat sheet.

The invention is described in following by means of an example of the process in operation, represented more or less in diagram form in the drawing.

They show:

In Figure 1 — A perspective drawing of a machine controlled by NC controls for the cutting of pieces of material from a band of material according to the invention,

In Figure 2 — A diagram of a vacuum device of the machine according to Figure 1 from a side view, holding a band of material in place during the cutting process,

In Figure 3 — A perspective drawing of a drive device for the carrier of the machine according to Figure 1, the cutting head carrier,

In Figure 4 — The cutting tool for the machine according to Figure 1, in diagram form,

In Figure 5 — A second way in which the cutting tool can operate, according to Figure 4, in diagram form,

In Figure 6 The cutting head for the machine according to Figure 1, in a perspective drawing, and

In Figure 7 In diagram form, a partial cross section of a side view of the cutting head according to Figure 6.

In Figure 1, a machine for automatically cutting to order, for example with NC controls, which is defined along general lines with reference number 20, is represented. A material (24) to be cut is on the cutting surface (26), also defined as the cutting table.

The cutting surface is comprised of a type of brush surface (28) (Figures 4 and 5) of synthetic fibers, approximately 0.5 mm thick and 5 mm in length, which is air-permeable, which covers the entire cutting surface and upon which the vacuum acts, which is generated by means of a generator (40)(Figure 2).

A cutting head (81) which holds the cutting tool (106) still to be described, is housed and moves in the X and Y directions, which coincide with the lengthwise and crosswise directions of the cutting surface (26). AS is shown in detail in Figure 3, a carrier (49) has been designed, which is fundamentally moveable in the X direction and a carrier (62), moveable in the Y direction. The X carrier (49) slides along rails (64), which are arranged in parallel to one another in the cutting area (26); while carrier Y's movement is crosswise and that of carrier X is lengthwise. Given that the movement in both directions takes place according to the same principle, only the movement in direction X is described here.

The drive of the carrier in direction X is comprised of a direct current motor (66), located at the front part of the cutting area, a tachometer (68) and a position regulator (70), which is controlled by a position servoregulator, not shown here. Through a reducing gear (72-74), the motor (66) moves on an axle (76), which is projected crosswise through the cutting table, over which a nonstop conveyor belt is guided, which supports the brush surface (28). At the free ends of the axle, there are toothed pulleys (78,80), by means of which the toothed belts (82,84) are guided, nonstop, which are kept taut by means of the toothed pulleys (86,88). The X carrier (49) is screwed to the toothed pulleys (84), through which it is synchronized in movement with the belts (82,84).

On carrier X (49), there is a direct current motor (90), a tachometer (92), a position regulator (94), a gear (96,98) with drive pulleys (100), a toothed belt (102) and a tensing roller (104), which serve to drive carrier Y (62). The movements in direction Y are controlled in the same way that it is done in direction X, by means of a coordinated regulation of the position, for which purpose the habilitation signals for the X and Y regulation coils, in addition to the cutting tool (106) for the movement, rotation, around axle Z located perpendicularly to the cutting surface (26) are generated in a control apparatus (18).

AS is shown in Figure 4, the cutting tool (106) has one edge (108) which is oriented exactly in the direction of axle Z, perpendicular to the cutting s face (26), around which the cutting tool (106) rotates. In this way, the length of the edge of the blade (108) only has to be longer by a short safety distance, - reference num-

ber 112,- measuring approximately 2 - 3 mm longer than the pile (24a) of material to be cut. In this way, it is assured that, along the full length, the blade does not penetrate the cutting surface (26).

According to a second example of the working of the invention,we use a cutting tool (116) designed in a different way, principally, when few layers of cloth are to be cut. This cutting tool (116) is shown in Figure 5 and has one edge (118), which is located under a slight cutting angle (α) regarding the cutting surface (26). This angle is smaller than the right angle, which is formed by the edge (108) in Figure 4, regarding the cutting surface (26). This arrangement makes the cutting easier and enhances the movement of the tool.

Although it may depend on the cutting to be done, the cutting tool can vary, the drive in the form of a transducer (30) (emitter) is the same, see Figure 7. By means of the transducer, the cutting tool is started vibrating from 20 to 40 Khz, with amplitudes of from a few hundreths to a few tenths of a millimeter, with higher or lower intensities, depending upon the material and the height of the cut, utilizing for this process the general principles of an ultrasonic procedure, as is, in itself, already known. For this purpose, an ultrasonic generator (31) (Figure 1) is provided for, not shown in greater detail, which generates a sequence of electrical signals, which are transmitted by means of a cable (32) (Figures 6 and 7) and a so-called convertor (34) of the transducer, which convert the electrical signals into mechanical vibrations, which are transmitted to a booster (36), which has the special shape as seen

to Figure 7. A booster of this type is a mechanical amplifier. Lastly, the transducer (30) also includes a "Sonotrode" (38), on which the cutting tool is mounted. Here, ultrasonic energy is used. One part of this is represented by the blade. The geometric forms can also vary regarding the shape shown, depending upon the cutting tool, to thus achieve an ideal adaptation, the booster and the Sonotrode thus form a coupling element.

In Figures 6 and 7, other details of the cutting head are shown. In these figures, one can see a motor (60), which serves to adjust the blade around axle Z. The motor (60) drives the cutting group defined in conjunction with 73 by means of cogwheels (63 and 65), See Figure 7. For this purpose, the cogwheel (65) used as a pulley is joined to a hollow axle (67), rotating in a housing on the ball bearings (69 and 71), which, in turn, are located on the crossbar (66) of the unit (73). The crossbar (66) is joined to the Y carrier (62). Also see Figure 3. A carrier (75), working in an up and down movement, mounted on the crossbar (61), positioned on the cogwheel (65), supports the ultrasonic emitter or transducer (30) and can be moved by means of a cylinder (77). The cutting head (81) is thus moveable in the X or Y direction by means of carriers X and Y, described in relation to Figure 3; and in direction Z, fundamentally only the cutting tool, by means of carrier Z (75), previously described in relation to Figure 7, while the rotation of the cutting tool around axle Z takes place by means of the motor (60)

The control in the control apparatus (18) must be set in such a way that the rotation around axle Z is not over 360º or 2 x 360º, for the purpose of avoiding a crossing of the cables and feeder lines;

to the contrary, rotating joints would have to be used. However, the cutting head has to be able to mvoe within these limits and with a free-run movement - for this purpose, without any cutting movements - to adopt the 0º position.

Although the possibility does also exist of using sliprings as couplers for the cables and feeder lines.

The cutting ehad, according to Figure 7, also has a presser bar (79), by means of which the material to be cut, for example a cloth, is pressed down slightly,by the action of a spring (83),against the cutting surface (26).

The pressure bar is mounted on the hollow axle (67) in the area of the passing blade (106). The spring (83) is supported by a base (89), also mounted on the hollow axle.

0202676

PATENT CLAIMS

1. Procedure for cutting pieces of material to order from a piece of material having one layer or several layers, using a cutting table equipped with a vacuum installation for holding the band of material in place and a slide moving lengthwise and crosswise of the cutting table as the carrier of a cutting tool, the movements of which, along the cutting lines, are controlled by means of a data processor which processes the marking data and the data control, with the feature of a cutting tool driven by ultrasound and an endless conveyor belt with a synthetic fiber base, the individual fibers of which are approximately 0.5 mm in diameter and 5 mm in length, as the means of transport for the band of material in the cutting area and as a cutting base, and through a step-by-step movement of the conveyor belt with a wide range, which, for the purpose of the finished cut of a piece of material, is greater than the most ample movement of the cutting tool in the longitudinal direction (X), which is moved, in each case, only following the transport phase with the conveyor belt, stationary along the cutting lines.

2. Procedure, according to claim 1, characterized by the fact that the cutting movements are carried out perpendicaularly to the surface that serves as the base for the material to be cut and are produced by an ultrasonic generator.

3. Installation for carrying out the procedure of cutting pieces of material to order, from a band of material, according to claims 1 and 2 characterized by a cutting table (26) and a carrier (49) moving lengthwise (direction X) and crosswise (direction Y) of the cutting table for the cutting tool (81), the movements of which, along the desired cutting lines, are controlled by a data processor (18) which is numerical and which processes the marking data and control data, by a vacuum installation for holding the band of material in place on the cutting table, by a cutting tool which is knife-shaped (106, 116), which is fitted with an ultrasonic generator (30) and by a nonstop conveyor belt (26) which serves as a cutting table, with synthetic fibers running in the same direction as the cutting and which are approximately 0.5 mm in diameter and 5 mm in length, which is guided step by step, at least, through a transport area and a wide-range cutting area, which for the finished cut of a piece of material, is greater than the most ample cutting movement of the cutting tool in the longitudinal direction (X).

4. Installation according to claim 3 characterized because the cutting tool (106) has one edge (108) perpendicular to the cutting surface and which is housed in such a way that it can rotate around the axle, which is also perpendicular to the cutting surface (26).

5. Installation according to claim 3 characterized because the cutting tool (116) has one edge (118) which forms an angle

(∝) with the cutting surface and is housed in such a way that it can rotate around an axle that is perpendicular to the cutting surface (26).

6. Installation according to claims 2 and 3 characterized because the swing amplitude of the ultrasonic emitter (30) has dimensions which allow the blade to penetrate the surface of the cutting table (26) on cutting the band of material.

7. Installation according to claim 6 characterized because the blade (106, 116), a coupling element (38) and the ultrasonic emitter (30) comprise a cutting unit (73) which is housed and moves up and down, and which is located on a disc comprised of a cogwheel (65), the bearing of which has a hollow central axle (67), which surrounds the coupling element (38), the hollow axle of which is housed rotating on a crossbar (66) joined to carrier Y (49).

8. Installation according to claim 6 characterized because a regulating cylinder is assigned to the cutting group (77).

9. Installation according to claims 6 and 7 characterized because the hollow axle (67) has a presser-bar (79) that is spring-loaded, in the area in which the blade (106, 116) passes through.

Fig. 1

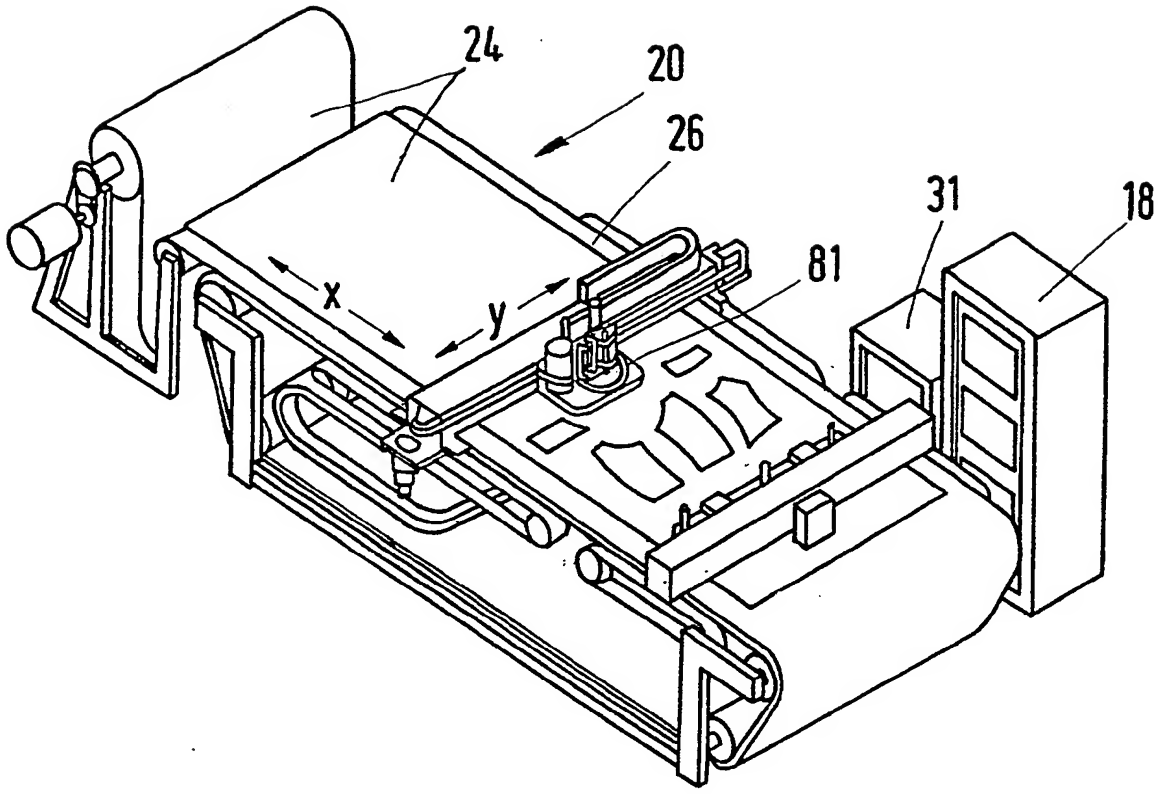


Fig. 2

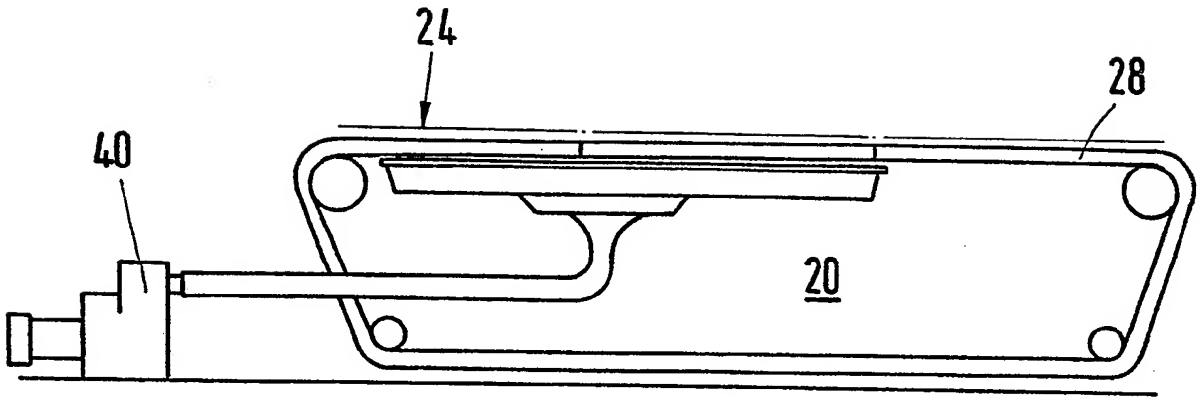


Fig. 3

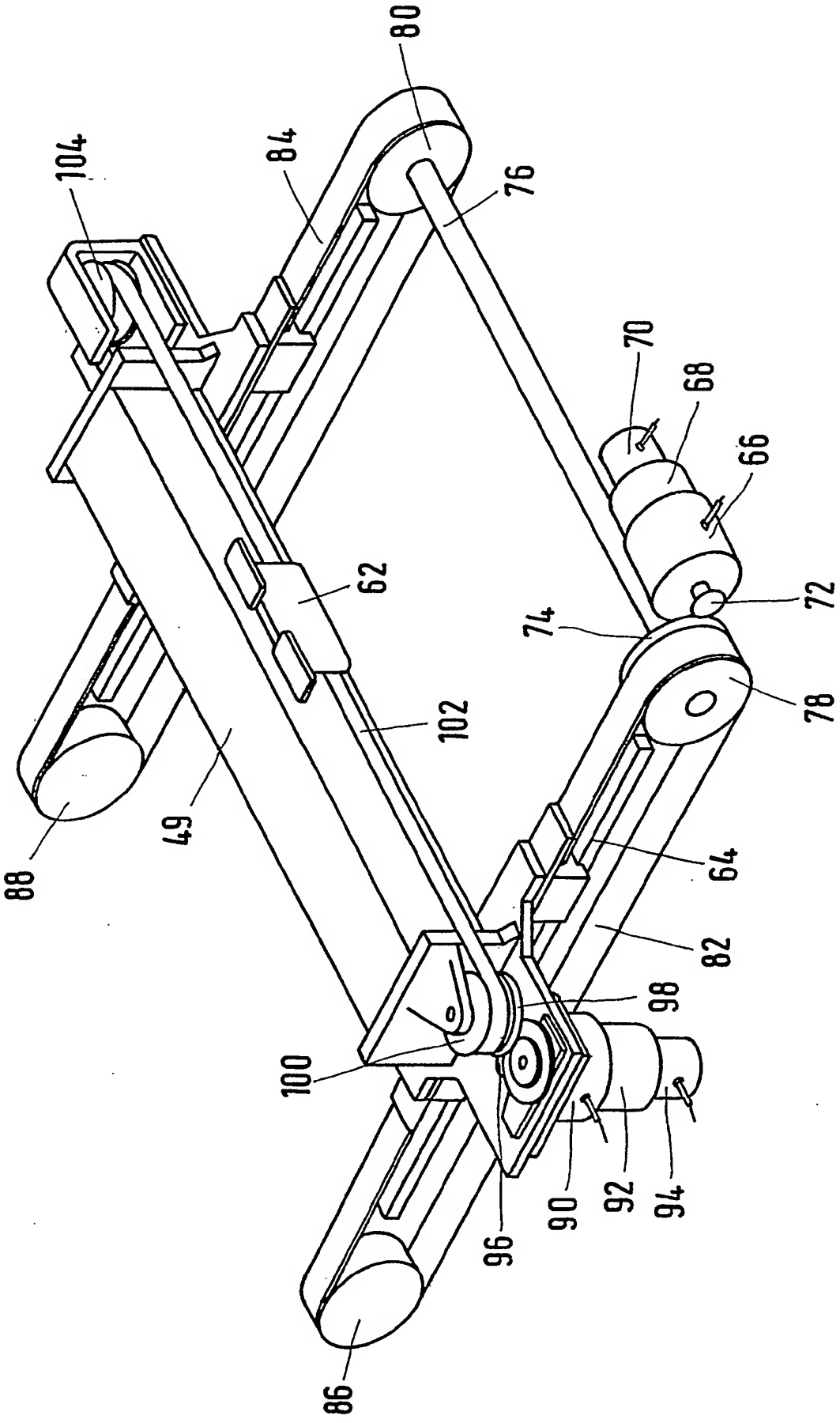


Fig. 4

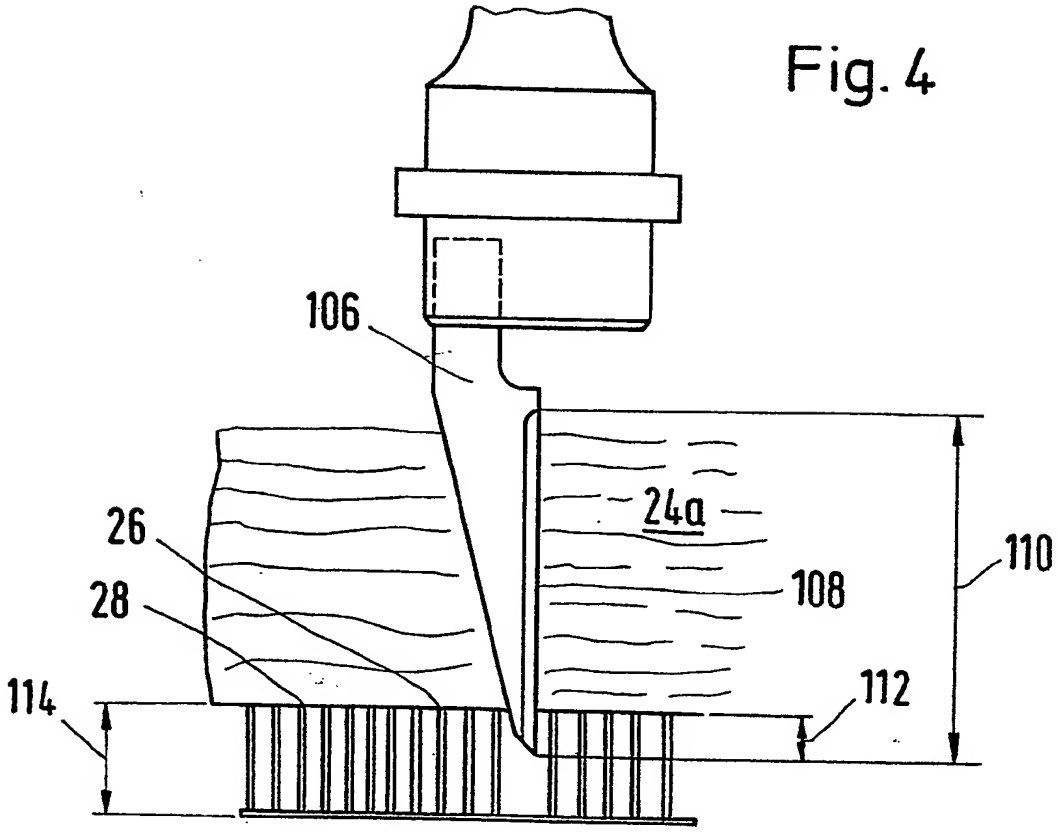


Fig. 5

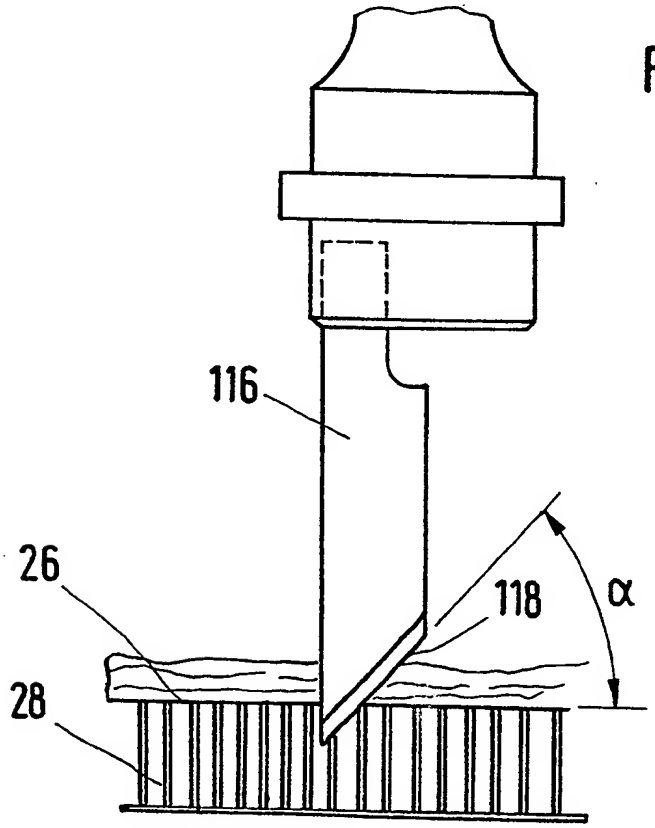


Fig. 6

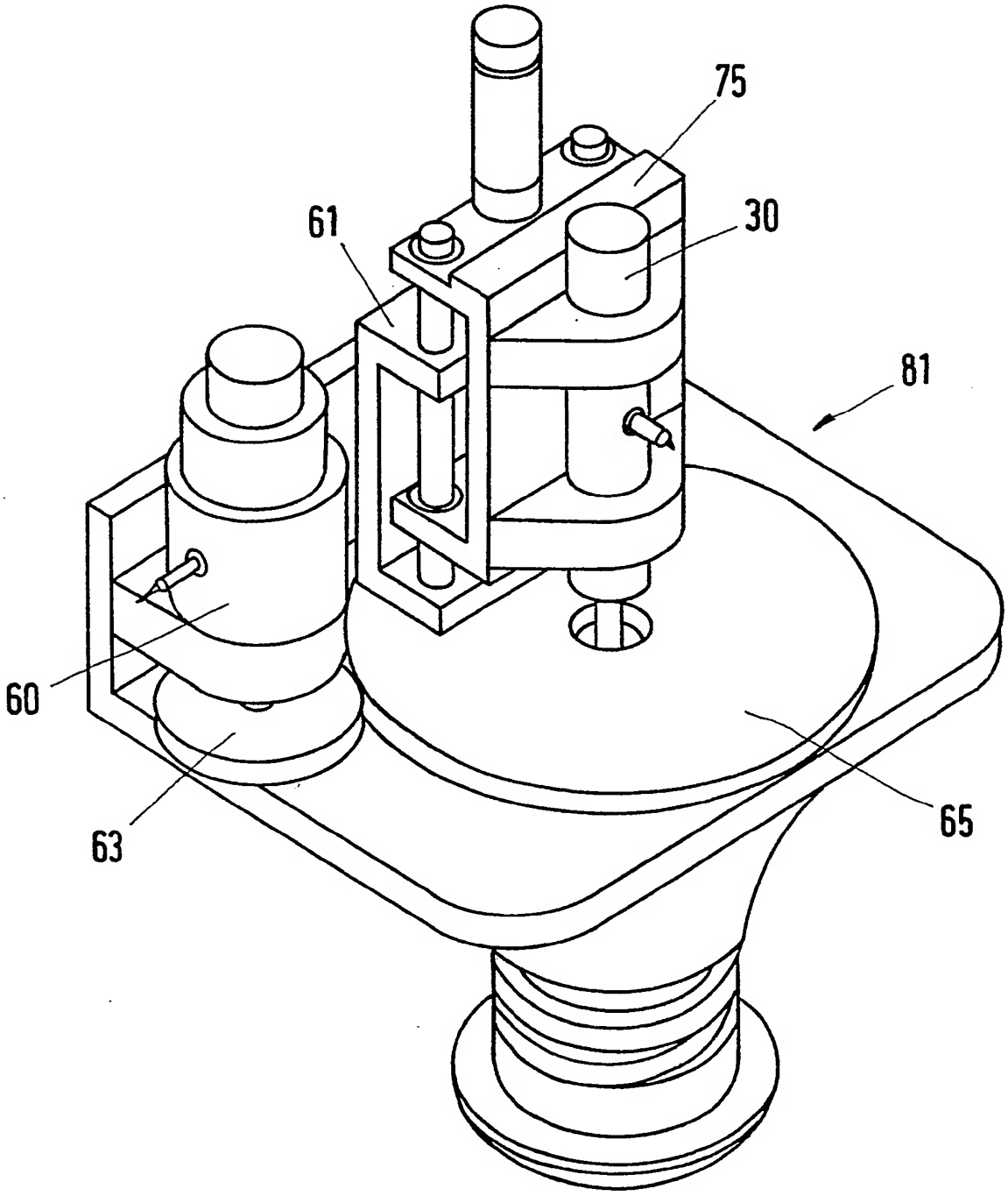
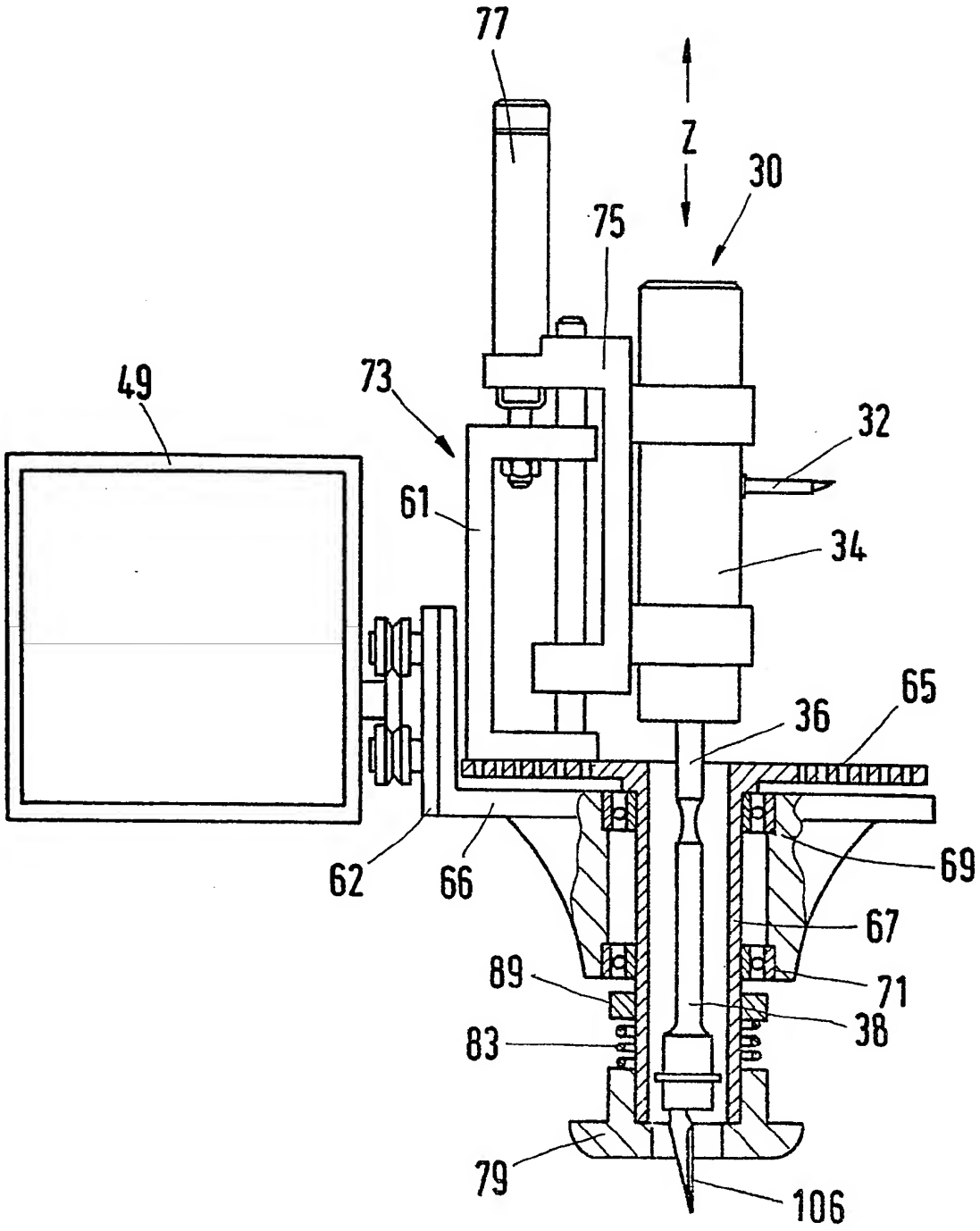


Fig. 7



(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 202 676**
A3

(12) EUROPEAN PATENT APPLICATION

(21) Application number: 86106923.5

(51) Int. Cl.³: B 26 F 1/38

(22) Date of filing: 21.05.86

(30) Priority: 22.05.85 ES 543394

(43) Date of publication of application:
26.11.86 Bulletin 86/48

(88) Date of deferred publication of search report: 26.08.87

(84) Designated Contracting States:
AT BE CH DE FR GB IT LI LU NL SE

(71) Applicant: INVESTRONICA S.A.
Tomás Breton, 62
E-28045 Madrid-7(ES)

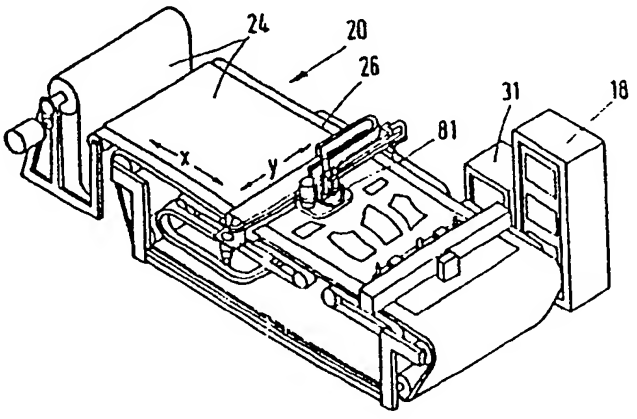
(72) Inventor: Becerra Carrasco, Rodrigo
Urbanización 109 Villas F-17
Pozuelo Estación (Madrid)(ES)

(72) Inventor: Alcantara Perez, Bernardo
C/Rioja no. 13-4 B
Madrid(ES)

(74) Representative: Puschmann, Heinz H. et al,
Spott und Puschmann Patentanwälte
Sendlinger-Tor-Platz 11
D-8000 München 2(DE)

(54) Procedure for automatically cutting pieces of material to order, using a band of material and a device for carrying out the procedure.

(57) Procedure and device for cutting pieces of material to order, from a band of material (24), by using a cutting table (26) equipped with a vacuum installation for holding the band of material in place and a workable, longitudinal and traverse slide (49,62) on the cutting table, running along the desired cutting lines, which is controlled by a data processor (18) for marking and data control, as the carrier of a cutting tool (106) driven by ultrasound, for the purpose of which a conveyor belt (28) with a base similar to a brush serves as the means of transport for the band of material (24) in the cutting area and as a cutting base, which is moved, step by step, by means of a slide range that, for the finished cut of a piece of material, is larger than the cutting tool's (106) most ample movement in the longitudinal direction (X), for which purpose, the cutting tool (106) in each case is only moved following the transportation phase, with the conveyor belt (28) being stationary all along the cutting lines.



EP 0 202 676 A3

European Patent Office

EUROPEAN SEARCH REPORT

Application number

EP 86 10 6923

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int Cl 4)
Y	GB-A-2 019 295 (STUMPF) * Page 1, lines 5-25,59-97,112-115; page 3, lines 7-24,28-34; figure 1 *	1-4	B 26 F 1/38
A		6,7,9	

Y	DE-B-1 053 151 (KEMPKES) * Column 1, lines 17-24; column 2, lines 31-38; column 3, line 30 - column 4, line 2 *	1-4	

A	GB-A-1 543 258 (GERBER) * Page 1, lines 80-88; figure 8 *	5	

A	GB-A-2 090 784 (GERBER) * Page 1, lines 5-37; page 4, lines 4-48; figures 1,2 *	1-4,6	TECHNICAL FIELDS SEARCHED (Int. Cl.4)
	---		B 26 F B 26 D A 41 H
A	GB-A-2 087 290 (GERBER)		

A	GB-A-2 079 213 (GERBER)		

A	US-A-3 538 966 (COLLINS)		
	--- -/-		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	18-06-1987	HUGGINS J.D.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO Form 1503 03 82

European Patent Office

EUROPEAN SEARCH REPORT

Application number

EP 86 10 6923

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int Cl.4)
A	ER-A-2 450 772 (STUMPF)		
A	GB-A-2 069 181 (GERBER)		
A	US-A-3 817 141 (SIMONETTI)		
P,A	GB-A-2 148 175 (GERBER)		

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	18-06-1987	HUGGINS J.D.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO Form 1503 03.82